Dams and Livelihood: The Problems of Parasitic Diseases in Communities Hosting Dams in Nigeria

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Abstract

River basins are well known as the cradles of civilization and cultural heritage. Ancient and modern communities have depended on them for livelihood, commerce and habitat. Dams, one of the many man-made alterations to the river basins, have been built for centuries and without doubt have contributed to the development of many nations, but the social, health and environmental costs have in too many cases been unacceptable and often unnecessary. Environmental changes and social disruption resulting from dams and associated infrastructures such as irrigation schemes have significant adverse health outcomes for local populations and downstream communities. In Nigeria, out of a total of 323 dams that have been identified in the literature, 47 dams have been surveyed for snail intermediate host of schistosomaiasis, a parasitic disease that has affected over 200 million people in 75 countries. Out of 11 of the 47 dams investigated for human infection, 10 were positive. These findings revealed that dam construction contributes to the spread, endemicity and incidence of schistosomaiasis in Nigeria. This paper discusses the problems, looks at the existing institutional and legal frameworks, and suggests measures necessary to achieve sustainable management of river basins affected by developmental projects in Nigeria and elsewhere.

Key words*: Dams, Schistosomiasis, River basin, Health, Water resource management, Livelihood, Artificial lakes*

Introduction

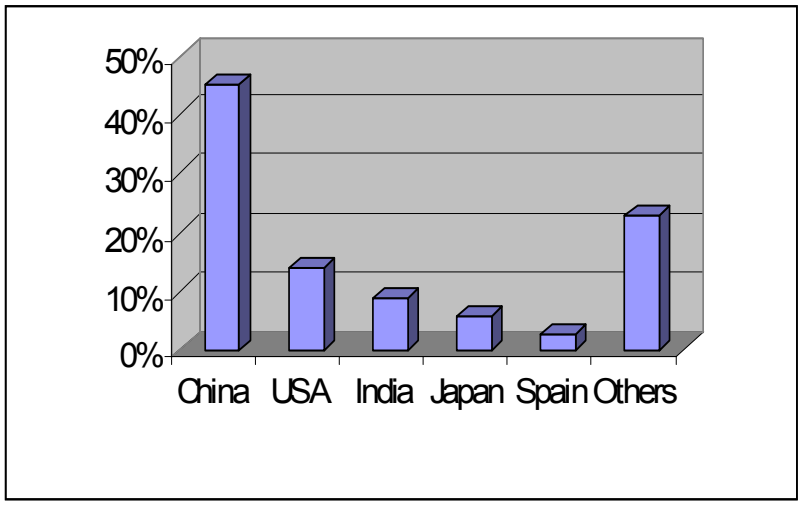
Conceptually, a river system may be seen as an ecological continuum in which there is a relationship between community production and respiration changes along the river from the highly canopied areas to slow meandering areas near the mouth of the river. River basins are well known as the cradles of civilization and cultural heritage. Ancient and modern communities have depended on them for livelihood, commerce and habitat. The river continuum however is profoundly affected when subjected to alteration, which may be natural or human generated.

One of the many man-made alterations is the construction of dams. Dams are barriers constructed across a stream or river to harness water for one or more of the following uses: to concentrate the natural fall of a river at a given site in order to generate electricity; to direct water from rivers into water supply systems; to direct water into canals and irrigation systems; to increase depths for navigational purposes; to control flow during times of flood and droughts; and to create artificial lakes for fisheries and recreational use. Many dams are multipurpose and fulfill several of these functions.

Globally, the last century witnessed a dramatic increase in the construction of large dams. By 1949, about 5,000 large dams had been built worldwide, three-quarters of them in industrialized countries. At the end of the 20th century over 45,000 large dams had been built in over 140 countries of the world (ICOLD, 1998). The top five dam-building countries are China, the United States, India, Spain and Japan, which account for nearly 80% of all large dams worldwide (Figure 1). China alone has built around 22,000 large dams, the USA over 6,390; India has over 4,000 dams while Spain and Japan have between 1,000 and 1,200

dams each. Today, approximately two-thirds of the world's existing dams are in developing countries.

Figure 1. World distribution of dams



In Nigeria, there has been an upsurge in dam construction in the past three decades. Ofoezie (2002) identified a total of 323 dams out of which 246 (76.2%) were constructed between 1970 and 1995. The effect of the Sahelian drought of 1972-1975 aggravated the already stressed food security situation in the country, prompting the various levels of government to embark on a rigorous policy to increase food production. To achieve this, the impoundment of river basins was seen as inevitable to provide sufficient water for year-round irrigation, which led to the construction of over 246 dams (Imevbore *et al.*, 1986). Ofoezie reported that of the 323 dams in Nigeria, 106 were large dams (dams with walls higher than 15m, or 10-15m high with a crest length of over 500m, or having a reservoir capacity of 1 million m^3); 27 were medium sized dams (with walls 8-10m high); and 192 were small dams (walls less than 8m).

While many benefits have been derived from the services of dams, their construction and operation have led to many significant negative social, health and human impacts. The negative effect this has had on population includes direct displacement of families. An estimated 40-80 million people have been displaced world-wide by the construction of dams (WCD, 2000). In many cases, host communities are resettled and their livelihood and access to resources of riverine communities, especially those downstream of dams, are affected in varying degrees. In many cases, whole societies have lost access to natural resources and cultural heritage submerged by reservoirs of dams.

The environmental changes and social disruption resulting from dams and associated infrastructure such as irrigation schemes have significant adverse health outcomes for local populations and downstream communities. Among the resettled, access to drinking water and to health services and ability to cope with new social and physical environments determine health conditions. In tropical areas, numerous vector-borne diseases are associated with the reservoirs of dams. The most common of these diseases is schistosomiasis, a parasitic disease causing untold misery in 75 countries (WHO, 1985), affecting over 200 million people worldwide with 500-600 million more exposed to infection (Webbe, 1981).

Schistosomiasis is associated with water resource development projects such as dams and irrigation schemes, where the snail is the intermediate host of the parasite breeds. The snail intermediate host breeds in slow-flowing or stagnant water. Hence, the main courses of large rivers are not usually a major source of schistosomiasis, but waters sustained by them through seasonal flooding, impoundment and extraction for irrigation are important transmission sites (Ogbeide and Uyigue, 2004). The disease is essentially an infection of rural and agricultural communities where the way of life of people promotes the contamination of inland water with human excreta.

This paper looks at the role of dams in influencing the transmission, endemicity and incidence of schistosomiasis as it affects the health of communities hosting them in Nigeria. It assesses the existing government institutions responsible for water resource management, particularly in view of protecting public health from water-transmitted diseases, and suggests possible control measures through administrative and legal mechanisms. The paper also highlights the role of governmental, non-governmental, and intergovernmental organizations in bringing about mitigation measures to control water-related diseases in affected communities.

Schistosomiasis in dams

In terms of schistosomiasis endemicity, Nigeria has been divided into three zones: hyperendemic zone, moderate zone and zone with low or no endemicity. About 192 (59%) of these dams are located in the 10 hyperendemic states, 50 (16%) are located in moderately endemic states and 81 (25%) are located in low/no endemic states and the Federal Capital Territory, indicating a greater tendency to build dams in hyperendemic zone than in other Zones (Cowper, 1973).

A total of 47 (15%) of the 323 dams have been surveyed for the presence of snail intermediate host species of schistosomiasis, putting into consideration its distribution and ecology. The survey revealed that 45 out the 47 dams are located in the hyperendemic zone while the remaining two are located in the moderately endemic zone. Results show that 20 (43%) of the total surveyed harboured *Bulinus globosus* and/or *Biomphalaria pfeifferi*, the local intermediate host of the *Schistosoma* parasite. Eighteen of these are located in the hyperendemic zone while the other two are in the moderately endemic zone. Fifteen of them are in the northern part of the country while the remaining five are in the Southwest (Ofoezie, 2002).

Since the snail intermediate host of schistosomiasis breeds in slow-flowing/stagnant water, reservoirs of dams have provided favourable conditions for year-round transmission of the disease even in areas where snail distribution used to be seasonal (Betterton *et al.,* 1988). Imevbore *et al.* (1986) reported that within the reservoirs, distribution is focal and is confined to the human contact sites, especially along their shallow vegetative shore, not more than few meters from the shores or deep into the water. The reports of Okwosa and Ukoli (1980) and Smith (1982) revealed that in Nigeria, snail density is not significantly affected by water turbidity, temperature, alkalinity, acidity and the presence of major ions, but is significantly limited by conductivity, dissolved oxygen, biochemical oxygen demand and the presence of aquatic vegetation.

Table 1: The distribution of snail host and human schistosomiasis in investigated artificial lakes in Nigeria

S/N	Name of dam	Location	Size	Purpose	Year	Snail	Human infection
1	Birmin Kudu	Kano	Small	MP	1970	Nil	NI
2	Rimin Gado	Kano	Small	WS, RC	1978	+VE	+VE
3	Wurno	Sokoto	Small	MP	1960	+VE	+VE
4	Kubani	Kaduna	Medium	WS	1975	+VE	NI
5	Bagoma	Kaduna	Large	WS, IR	1974	+VE	NI
6	Kangimi	Kaduna	Large	WS, IR	1977	+VE	NI
7	Zaria	Kaduna	Large	MP	1974	+VE	NI
8	Baugauda	Kano	Large	MP	1970	+VE	NI
9	Challawa Gorge	Kano	Large	MP	1992	Nil	NI
10	Gari	Kano	Large	MP	1980	Nil	NI
11	Jakara	Kano	Large	MP	1976	Nil	NI
12	Kafin Chiri	Kano	Large	MP	1977	Nil	NI
13	Kango	Kano	Large	MP	UC	Nil	NI
14	Karaye	Kano	Large	MP	1971	Nil	NI
15	Magaga	Kano	Large	MP	1990	+VE	NI
16	Marashi	Kano	Large	MP	1980	Nil	NI
17	Pada	Kano	Large	MP	1980	Nil	NI
18	Ruwan Kanya	Kano	Large	MP	1976	+VE	NI
19	Tiga	Kano	Large	MP	1975	+VE	+VE
20	Tomas	Kano	Large	MP	1976	+VE	+VE
21	Tudun Wada	Kano	Large	MP	1977	Nil	NI
22	Watari	Kano	Large	MP	1980	Nil	NI
23	Malumfashi	Katisina	Large	MP	NA	+VE	+VE
24	Zobe	Katisina	Large	MP	NA	+VE	+VE
25	Warwade	Kano	Large	MP	NA	Nil	Nil
26	Oyan	Ogun	Large	MP	NA	+VE	+VE
27	Achika	Kano	Large	WS	NA	Nil	NI
28	Eleiyele	Oyo	Large	WS	1942	+VE	NI
29	Oba	Oyo	Large	WS	1964	+VE	NI
30	Opeki	Oyo	Large	WS	1967	+VE	NI
31	Goronyo	Sokoto	Large	MP	1983	Nil	Nil
32	Bakolori	Zamfara	Large	MV	1982	+VE	+VE
33	Dangada	Kano	Small	FL	NA	Nil	NI
34	Dogwala	Kano	Small	FL	NA	Nil	NI
35	Duduvum	Kano	Small	FL	NA	Nil	NI
36	Gata	Kano	Small	FL	NA	Nil	NI
37	Garanga	Kano	Small	FL	NA	Nil	NI
38	Rugunsana	Kano	Small	FL	NA	Nil	NI
39	Gulka	Kano	Small	FL	NA	Nil	NI
40	Iggi	Kano	Small	FL	NA	Nil	NI
41	Guzu Guzu	Kano	Small	FL	NA	Nil	NI
42	Kefin Gana	Kano	Small	FL	NA	Nil	NI
43	Kiwia	Kano	Small	FL	NA	Nil	NI
44	Kiyako	Kano	Small	FL	NA	Nil	NI
45	Kara Dumba	Kano	Small	FL	NA	Nil	NI
46	Kainji	Niger	Large	MP	1968	+VE	+VE
47	Opa	Osun	Large	WS	1980	+VE	+VE

Source: Ofoezie, 2002

Notes: MP = Multipurpose use
WS = Water supply
RC = Recreation
IR = Irrigation
NA = Not available

NI = Not investigated
+VE = Positive
FL = Flood control
UC = Under construction

Human infection and dams

Out of the 11 dams that have been investigated for human infection with schistosomiasis, 10 were positive (Table 1). Eight of the ten lakes with positive cases and only one with no positive case are located in the hyperendemic zone. Also eight are in the north, while only one is in the southwest. The remaining two are in the moderately endemic zone. The prevalence of shistosomiasis infection ranged from 2.1% in communities around Zobe Lake to over 80% in Oyan Lake (Ofoezie, 2002).

As mentioned earlier, the main courses of rivers are not usually sources of schistosomiasis, but the water sustained by them is. Ogbeide and Uyigue (2004) reported 95% prevalence in Ipogun Community in western Nigeria that depends on Aponmu River as their source of drinking water and for other domestic activities. Aponmu River takes its source from the Owena River, the basin hosting two dams – the Owena Dam in Idanre Local Government Area and Owena Multipurpose Dam (under construction) located at Kilometer 10, Igbara-Oke in Ifedore Local Government Area. The stagnancy in the Aponmu River has been attributed to the damming of the Owena River (Ogbeide and Uyigue, 2004).

Feasibility studies for dam construction have been carried out with little or no consideration of health, hence displaced persons were resettled on the banks of reservoirs with no health care, water or sanitation facilities. The case of the communities around Oyan Reservoir (Oyan Dam is in Ogun State in western Nigeria and was completed in 1984) is worth mentioning. The communities witnessed an outbreak of urinary schistosomiasis four years after construction. An initial examination that was conducted in 1988 recorded an overall prevalence of over 80% with high rates in all age and sex groups. The intensity of infection was equally high. Despite mass treatment at the time of initial investigation, the infection pattern had reverted to pre-treatment levels in 1992 when a follow-up investigation was conducted (Ofoezie, 2002).

Ogbeide and Uyigue (2004) reported a similar occurrence in Ipogun Community, where the government carried out mass treatment after which the disease resurged into an epidemic situation. The resurgence occurred because the root of the problem was not attended to, that is, the occurrence of the parasite in the reservoirs. Control measures should involve an integrated approach, which should include the provision of adequate safe drinking water for the communities to reduce their dependency on the reservoir, provision of health care facilities, educating the communities and proper management of reservoirs.

Institutional management of dams

In Nigeria, the Federal Ministry of Water Resources (FMWR) is the authority responsible for the management of dams. FMWR functions through the National Council of Water Resources (NCWR), which is the highest policy body, and the National River Basin Development Coordinating Committee (NRBDCC), which coordinates the activities of the river basin development authorities. The NCWR is chaired by the Minister for Water Resources and other members include the state commissioners of relevant ministries. There is also a National Technical Committee on Water Resources (NTCWR), which has five subcommittees attached to it. The subcommittees provide technical information necessary for the functioning of NTCWR. NTCWR is chaired by the Director of Federal Ministry of Water Resources, while other members include the general managers of the River Basin Development Authorities (RBDA), National Electric Power Authority (NEPA), state water boards and corporations, the

Director of the Meteorological Services and state chief irrigation officers. One of the five subcommittees is the Subcommittee on Dams. In none of these committees or subcommittees is the Federal Ministry of Health and Environment represented.

The functions of the Subcommittee on Dams are:

i) To serve as national committee for the International Commission on Large Dams (ICOLD)
ii) To update, compile and publish an inventory of Nigerian dams
iii) To investigate practices and regulations of private, state and federal agencies in connection with the planning, design, construction, maintenance and operation of dams
iv) To investigate and publish sociological effects of dams
v) To undertake the study of management problems of dams and storage schemes
vi) To prepare and publish codes of practice for the planning and design of dams

The river basin development authorities (RBDAs) are responsible for the management and day-to-day running of the government-owned dams. They are eleven in number and were established under decree No. 25 and 31 of 1976 and 1977 respectively. The eleven RBDAs are spread across the country for the effective coverage of the nation's river basins and each has the responsibility to develop water resources within its area of jurisdiction. However, in their activities, there is no specific provision for health impact assessment (HIA) or the mitigation or control of vector-borne diseases in river basins.

The law and river basin management

The Nigerian Criminal Code of 1916 was an earliest legal provision for water resource pollution control. Section 245 of this code stipulates six months' imprisonment for polluting or contaminating an inland freshwater body. The law was further strengthened in 1988 and the Federal Environmental Protection Agency (FEPA) was established to regulate the Nigerian environment. FEPA, with respect to water resources management, was mandated to establish water quality standards for different uses and limitations on effluents for new and existing source points. FEPA was strengthened by the Environmental Impact Assessment (EIA) decree No. 86 of 1992. The agency was given the mandate to evaluate development proposals to ensure early consideration of their environmental effects. Specifically, the EIA decree stipulates that all industrial and agricultural projects likely to have a major impact on the environment should be made subject to approval by the appropriate government agency following preparation of an EIA. EIA components are as follows:

- Description of the proposed activities
- Description of the potentially affected environment including measures to be used in assessment
- Description of practical activities to be involved
- Description of potential environmental impacts at local, regional or global levels, as well as long- and short-term effects
- Identification and description of available measures to mitigate the potential adverse environmental impacts.

Apparently, requirements for approval of development projects lack health impact components. In the FEPA decree of 1988, pollution was defined as "man-made or man-aided alteration of chemical, physical or biological quality of the environment to the extent that it is detrimental to that environment". The definition suggests that disease transmission, which is biological, should be an integral aspect of feasibility studies before developmental projects. Yet health impact assessment (HIA) is not listed as a requirement for EIA under the current law establishing FEPA.

Discussion

The review has shown that dams have been built for centuries and have contributed to the development of many nations, but the social, health and environmental impacts on riparian communities have in many cases been unacceptable. The environmental and social disruption resulting from the construction and operation of dams have led to the incidence and transmission of many vector-borne diseases, among which schistosomiasis is very prominent, a disease that has been reported in 75 countries, affecting 200 million people globally.

The reservoirs of dams (artificial lakes) create an environment suitable for the breeding of the snail intermediate host of the disease. These snails breed in stagnant or slow-flowing water bodies, hence the natural courses of rivers are not usually the major sources of the disease. In Nigeria, out of the 11 dams that have been surveyed for human infection with schistosomiasis, 10 dams were positive. The presence of the snail intermediate host has been reported in 20 dams out of the 47 dams that have been surveyed. It is an established fact that dams are associated with the transmission of schistosomiasis and other vector-borne diseases.

The Nigerian institutional structure for the management of dams lacks adequate mechanism for the control of vector-borne disease along river basins that have been altered by the construction of dams. The review revealed that the health of the communities hosting these facilities was not given consideration during the planning and operation of the dams. Displaced persons were resettled on the bank of the lakes with no health care, sanitation or water supply facilities made available to them.

The National Technical Committee on Water Resources (NTCWR) and its five subcommittees provide information for the functioning of the National Council of Water Resources, which is the highest policy making body. In none of these committees and subcommittees is the Federal Ministry of Health and Environment represented, nor is any other body having the capacity to identify environmental and health effects of dams. There is no provision for the mitigation and control of vector-borne disease among the functions of the eleven river basin development authorities (RBDAs) established in different regions of the country. It is clear that issues of health were not taken into consideration in water resources development in Nigeria.

Going by the definition of pollution in the FEPA decree of 1988, vector control and disease mitigation should be an integral component of its goal – to regulate the Nigerian environment. Parasites and their vectors are important biological entities and are essential indicators of the level of risk people are exposed to in any community. This factor is therefore an indispensable ingredient in any impact assessment for development projects, especially where they have to involve a large number of people. Yet, in Nigeria, it is clear that EIA lacks provision for HIA, which apparently means that it cannot exert control over water transmitted vector-borne diseases.

Conclusion and Recommendations

In the Nigerian context, as it has been reported in other parts of the world, it is clear that though dams have contributed to the economic growth of the country, their construction and operation has had negative affects on the health and environment of the communities hosting them that can no longer be described as sustainable. Also, issues of health were not taken into consideration in the institutional structure for water resource development in Nigeria. Moreover, the legal infrastructure is inadequate for the development of sustainable water resource management. The requirements for approval of development projects lack health impact components.

It is therefore recommended that:

1. More investigations, at least to cover all the dams in Nigeria, should be conducted to establish the map of schistosomiasis and other dam-related diseases in artificial lakes.
2. Studies should also be conducted to elicit the socio-economic impact of dams in Nigeria and its relationship to the health and livelihood of riparian communities.
3. The EIA decree should be reviewed to include health impact components. A post impact assessment should also be conducted in all artificial lakes in Nigeria to determine present environmental and health impact status for precise mitigation action.
4. The Ministry of Health and Environment should be incorporated into the committees and subcommittees responsible for water resource management in Nigeria.
5. Private organisations, financial institutions, agencies of the United Nations and other development partners of Nigeria should provide financial and logistic support to local NGOs and institutions to embark on the empowerment and enlightenment of the affected communities.
6. The decision on projects affecting indigenous people should be guided by their free prior and informed process that can be achieved through formal and informal representatives.
7. The recommendation of the World Commission of Dams published in 2000 should be subjected to national dialogue to determine how best it can be applied in Nigeria.
8. For water supply and electricity generation, the government should begin to exploit other options that are renewable instead of building dams. Such options may include rainwater harvesting, use of wind and solar energy for electricity generation, desalination of sea water etc.

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